

## Executive Summary

This Phase III Report documents the background, purpose, and overall strategy for conducting a long-term ecological monitoring program for nine National Park Service (NPS) units in the western Great Lakes region of the United States. The proper planning of such an extensive program requires a major investment of time and funds to gather and synthesize background information and prioritize future monitoring needs. Hence, numerous background reports and documents were produced during the planning of this monitoring program. This document summarizes those efforts and provides the framework within which the monitoring program will be conducted. More detailed planning and background information can be found in supplemental documents and technical reports, which are referred to throughout this plan and are listed in Appendix A.

The NPS has organized 32 ‘networks’ of parks across the nation. Each network consists of several NPS units (parks) with similar ecology, geography, and management issues. This plan covers the Great Lakes Network (GLKN), which includes the following parks: Apostle Islands National Lakeshore, Grand Portage National Monument, Indiana Dunes National Lakeshore, Isle Royale National Park, Mississippi National River and Recreation Area, Pictured Rocks National Lakeshore, Sleeping Bear Dunes National Lakeshore, St. Croix National Scenic Riverway, and Voyageurs National Park.

The purpose of the monitoring program is to provide park managers with status and trends data on select indicators that represent the health of natural resources in the nine parks. These indicators are termed “Vital Signs” and they will be monitored long-term under a set of protocols that provide detailed guidance on the methods, schedules, analytical tools, and reporting procedures.

Parks in the Great Lakes Network range in size from Grand Portage National Monument at 287 ha (710 acres) to Isle Royale National Park, which is 231,396 ha (571,790 acres) in size. Six of the units are located on one of the Great Lakes, two are on large river systems, and one includes portions of the U.S. and Canadian border lake complex with a mosaic of freshwater lakes, ponds, and streams. Together, these parks represent the major freshwater ecosystems of the region; as such, freshwater is one of the defining elements of the Network. Yet the terrestrial systems are equally important. Vegetation of the northern parks is characterized as boreal forest with conifer lowlands and mixed deciduous and coniferous uplands with interconnected lakes, ponds, and waterways. Parks in the southern portion of the region are dominated by broadleaf forests, which harbor greater native plant and animal diversity than the northern forests. These southern areas are also more impacted by human development including large cities and transportation corridors. Climate in the region is mid-continental with mean annual precipitation ranging from 64.5 to 90.7 cm (25.4 to 35.7 in), and temperatures that vary from minus 40 °C (-40 °F) in winter to over 32 °C (90 °F) in summer. Due to lake effects near the Great Lakes, annual snowfall ranges widely from 71.1 to 342.6 cm (28 to 135 in).

To understand park ecosystems and to help select appropriate indicators to monitor, the Network commissioned the development of six conceptual models that

represent the primary ecosystems of the nine parks. The six models are: Upper Great Lakes Earth Processes, Great Lakes Forests, Great Lakes Wetlands, Inland Lakes, Large Rivers, and Great Lakes. Each model consists of a narrative and diagram(s), which summarize the major ecosystem drivers and stressors and identify important linkages, and possible measures. In each of the modeling efforts, climate and human development were identified as major agents of change. These agents of change cause ecological stress including extreme weather, resource extraction, pollution, and habitat fragmentation. The resulting effects include ecosystem contamination, changes in the distribution and abundance of native and exotic species, and altered soils and hydrology.

Through modeling efforts and meetings with park and partner scientists, the Network identified and prioritized 46 Vital Signs important for monitoring in the nine parks. This list of 46 was refined to a short list of 21 Vital Signs for which the Network expects to be able to design and implement monitoring protocols over the initial six years (2006 – 2011). Some of the remaining Vital Signs will be monitored by the individual parks, some are being monitored by partners, and still others will go unmonitored unless additional funding is made available. The 21 Vital Signs for which the Great Lakes Network intends to develop protocols in the first six years are:

- Air Quality
- Weather
- Land Cover/Use Coarse Scale
- Land Cover/Use Fine Scale
- Aquatic /Wetland Plant Communities
- Amphibians and Reptiles (Amphibians)
- Stream Dynamics
- Diatom Community
- Trophic Bioaccumulation
- Species Health, Growth and Reproductive Success
- Core Water Quality Suite (pH, specific conductance, dissolved oxygen, temperature)
- Advanced Water Quality Suite (nutrients, biotic indicators, and other factors)
- Terrestrial Plants
- Succession
- Terrestrial Pests and Pathogens
- Soils
- Plant and Animal Exotics
- Problem Species (White-tailed Deer)
- Bird Communities
- Fish Communities
- Water Level and Flow

The Network expects to monitor these 21 Vital Signs through the consistent application of 16 scientifically defensible protocols. The development of protocols will occur over the first six years with a push to implement 10 separate protocols covering 17 Vital Signs in the first two years (2006 and 2007). However, protocol development and the extent to which each Vital Sign is monitored depend on cost and future funding.

In 2006, we began field work for four monitoring protocols: water quality for large rivers, water quality for inland lakes, amphibians, and bioaccumulative contaminants. In 2007 we will strive to add five additional protocols: climate/weather, terrestrial vegetation, both coarse and fine scale land cover/ land use, and landbirds. Whether we meet our goal of implementing 10 protocols in the first two years will depend on hiring additional staff and the success of national efforts (e.g. climate/weather is being developed in-part by the nation inventory and monitoring program).

The Great Lakes Network will expend about 36% of its fiscal resources on data management. The data that results from this monitoring program will be subjected to

quality assurance/ quality control procedures and formal archival processes that are spelled out in a data management plan and in specific standard operating procedures for each protocol.

Data resulting from the Great Lakes Network monitoring efforts will be presented at an annual conference and meeting of park scientists and will be made available annually in summary reports. On a less frequent basis, the Network will analyze, interpret, and synthesize the data. The frequency with which analysis and synthesis reports are produced will depend on the Vital Sign and how often it is monitored. Where appropriate, the results will be submitted for publication in peer reviewed literature and/or presented at science conferences.

The Network's website ([www.nature.nps.gov/im/units/glkn/index.htm](http://www.nature.nps.gov/im/units/glkn/index.htm)) will be the primary means of making data and reports available. The website will be updated regularly to provide access to reports and raw data. A section of the Network's website, which is still under development, will be map-based using an Internet Mapping Service (IMS) to provide access to spatially explicit data and allow users to explore Network data in a spatial context. The Network's website will allow users to query and download data for use on local computers.

The Great Lakes Network has a central office in Ashland, Wisconsin with professional staff to coordinate and carry out the program. Natural resource staff and superintendents from each of the nine parks make recommendations and decisions on program direction and implementation through a Technical Committee and a Board of Directors. Oversight and guidance is provided by a Servicewide Inventory and Monitoring (I&M) Program and through the Midwest Regional Office (MWRO).